

REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1-2 and 25-35 are pending in this application. Claims 3-5 were withdrawn as being drawn to a non-elected Species. Claims 1, 2 and 25-35 have been rejected under § 102(b) or § 103(a). Independent claim 1 and dependent claims 2 and 35 have been amended. New claims 36-38 have been added.

§ 102(b) Rejections

The Examiner has rejected claims 1, 2, 25-31 and 35 under § 102(b) as being anticipated by Livingston (U.S. Patent No. 3,871,457). According to the Examiner, Livingston discloses an automatic fire sprinkler device comprising: an automatic fire sprinkler 44 for fluidly communicate with a water flow path 52, an orifice formed by seal ring 36 that is associated with the automatic fire sprinkler 44, the orifice being responsive to a water inlet pressure (see column 3, lines 39-45) to provide a plurality of different open cross sections, as the water inlet pressure increased, the pressure pushing on the diaphragm 34 and moving the diaphragm away from the seal ring, thus creating a plurality of different open cross sections and reaching the maximum opening at the dotted position in figure 1.

The Examiner's rejections are respectfully traversed. Livingston discloses an automatic fire sprinkler device having a bi-positional, on/off orifice. In the words of Livingston:

The flow control unit **22** contains a pressurized fluid such as gas, which exerts an upwardly directed force against the movable member **34** to urge it upwardly against the seal ring **36** to prevent the flow of fluid through the passage **14**. However, this force is selected so as to be less than the downwardly directed force against the movable member **34** caused by a predetermined fluid supply pressure which can be attained in the upper portion of the passage **14**. As a result, the movable member **34** will move to its retracted position in response to the pressure of the fluid in the upper portion of the chamber **14** attaining or exceeding this predetermined value, to permit the flow of fluid through the passage **14**.

In reviewing the entire patent document to Livingston, it is manifest that Livingston does not teach, nor fairly disclose, an "orifice being responsive to a water inlet pressure of said orifice, so as to provide a plurality of different, open cross-sections for a flow of water therethrough, as a function of said water inlet pressure", as claimed in independent claim 1. Livingston's bi-positional, on/off orifice is closed water pressure in the upper portion of the passage is less than a predetermined value. Above that predetermined value, movable member **34** is forced down into "its retracted position", such that the water passes into chamber **20**.

Movable member **34** has – inherently – only two positions: an expanded position, in which the pressurized gas exerts a pressure exceeding that of the water supply, and a retracted position, in which the pressure of the water supply exceeds the pressure of the pressurized gas.

Thus, not only does Livingston fail to teach, or to fairly disclose, an intermediate open position: the thin movable member 34 has, inherently, only two positions, corresponding to an open position and a closed position.

Moreover, it must be emphasized that an intermediate open position would actually be deleterious to the primary object of Livingston. Livingston describes an acute problem in fire protection systems:

The fire fighting capability of typical prior art fire protection systems employing a number of discharge heads mounted in an elevated position in the enclosure to be protected is often curtailed when the system is installed in relatively large storage facilities, such as warehouses, etc. One of the reasons for this is due to the fact that these large storage enclosures often contain very high stacks of combustible materials which frequently are highly inflammable. As a result, upon the development of fire in the enclosure, fire plumes or columns of 20 feet and higher may flare out beneath the ceiling of the enclosure and actuate numerous heads located at such a distance from the fire that they are ineffective to deliver water or other extinguishant to the surfaces of the combustible materials. This contributes not only to redundant and flooding use of the water, but, more significantly, robs water from the heads over the fire where it is needed to extinguish the fire. (column 1, lines 11-29).

Livingston's system differentiates between sprinklers that are acutely needed to deliver copious quantities of water to extinguish flames, and sprinklers that are essentially "false alarms", and rob pressure and water from those acutely needed sprinkler heads. An acutely needed sprinkler head will heat up from the flames such that fusible tip 40 melts, thereby releasing to the environment the pressurized gas in flow control unit 22 (see column 3, lines 52-58). With the resistance from the pressurized gas permanently removed, movable member 34 will be in the (sole) open

position for as long as there exists water pressure from the water supply. By sharp contrast, in those sprinklers that are essentially “false alarms”, fusible tip 40 will not melt, such that the sprinkler head is reversibly responsive to water pressure, and will return to the closed position once one or more acutely needed sprinkler heads are irreversibly activated. In the words of Livingston:

In the event the water pressure in the system later drops below the above-mentioned predetermined value, the pressurized gas within the flow control unit 22 will again force the movable member upwardly against the seal ring 36 to prevent any additional flow of fluid through the passage 14. (column 3, lines 46-51).

It is thus manifest that the function of the fluid control device taught by Livingston is to reversibly control the flow in an on/off fashion, such that the flow from sprinklers triggered by “false alarms” is completely shut off when the water is needed for other sprinklers that have been irreversibly activated. An intermediate flow corresponding to an intermediate pressure results in unnecessary flooding and a paucity of water for those areas requiring high flowrates of water.

It would appear that the Examiner’s rejection of claim 1 is based on the understanding that in the almost instantaneous switching from a closed position to an open position, the “orifice” of Livingston passes through several, transient, open positions, thereby reading on the language of claim 1, “a plurality of different open positions” in an inherent fashion.

Applicant respectfully submits, however, that claim 1, as previously amended, recites that the orifice is “responsive to a water inlet pressure of said orifice, so as to provide a plurality of different, open cross-sections for a flow of water therethrough, **as a function of said water inlet pressure**” (emphasis added). The orifice of

Livingston has only one unique open position as a function of water pressure.

All intermediate positions do not depend on the water inlet pressure. Rather, as is typical of many physical systems, these intermediate positions represent instantaneous, transient, non-equilibrium positions on the way to the system attaining a stable, equilibrium position that is determined by the difference between the water inlet pressure and the pressure exerted by the pressurized gas.

Thus, applicant steadfastly maintains that:

(1) Livingston teaches an automatic fire sprinkler that is, inherently, an on/off device.

(2) In this regard, Livingston is completely representative of all known, prior-art automatic fire sprinklers. This point was emphasized in the instant specification: “the K-factor in all prior art sprinklers is constant” (i.e., in an open position).

(3) Until the instant invention, there existed no known motivation for having an automatic fire sprinkler with an orifice that has a plurality of open positions, and that has a K-factor that is responsive to pressure in this plurality of open positions. No deficiencies in the known types of automatic fire sprinklers had been identified that would lead one skilled in the art to conceive and implement such an automatic fire sprinkler.

More specifically, nothing in the applied references supports the implementation of a pressure-based flow control unit within an automatic fire sprinkler system, so as to convert a conventional, automatic fire sprinkler into a fire

sprinkler whose K-factor – **over a plurality of open orifice positions** -- depends on the inlet water pressure.

(4) The problem solved by Livingston requires an on/off mechanism. Any intermediate open position(s) would appreciably detract from the function of the sprinkler.

(5) It must be emphasized that commercial automatic fire sprinkler systems were first developed over 120 years ago, and practice is widespread. The technology behind such systems is well developed and extremely mature.

Applicant has shown in the instant specification, and argued, that the cost of such fire sprinkler systems could be reduced using the inventive sprinklers, while -- at the same time -- improving safety and reducing damage due to fire and due to excessive use of water of prior-art systems.

In the field of automatic fire sprinkler systems, life safety, damage control, and capital expenditure are of cardinal importance. In the 30 years that have elapsed since Livingston issued, there is no commercially implemented device that attempts to solve the problems described in the instant Specification. More specifically, there is no commercially implemented device that attempts to solve these problems using the art taught by Livingston.

It is not surprising, therefore, that the device of the present invention has recently been accepted for publication in one of the prestigious journals of fire protection engineering. Experts in the field of fire protection engineering have concluded that the device represents an inventive, technological break-through in a mature, well-developed field.

Thus, Applicant continues to traverse the Examiner's rejections. However, Applicant has chosen, in order to expedite the prosecution, to amend independent claim 1 so as to clarify and emphasize the crucial distinctions between the device of the present invention and the art disclosed by Livingston. Specifically, claim 1 has been amended to clarify that the orifice, in being responsive to a water inlet pressure of the sprinkler, provides a plurality of open cross-sections, such that each open cross-section of said open cross-sections uniquely corresponds to a particular, unique water inlet pressure. This sharply contrasts with the device taught by Livingston, which has a water supply pressure threshold, above which the "orifice" is urged to a fully open configuration. Below this threshold, the "orifice" remains closed.

Dependent claim 35 has been amended so as to recite an additional limitation "so as to maintain said orifice in an intermediately open position". This additional limitation has been introduced to clarify and emphasize that, in sharp contrast to any transient intermediate positions of Livingston, the intermediate positions of the instant invention are "maintained", i.e., stable, equilibrium positions.

Support for amended claim 35 is drawn, inter alia, from original claim 24, and Figures 3a-3d and the text associated therewith, especially page 20, lines 13-17.

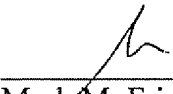
New Claims

New claims 36-38 have been added. Support for new claims 36 and 38 is drawn, inter alia, from original claim 24, and Figures 3a-3d and the text associated therewith, especially page 20, lines 13-17. New claim 37 is largely the same as claim 1, but recites an additional limitation that each open cross-section of the open

cross-sections “represents a stable, equilibrium cross-section” uniquely corresponding to a particular, unique water inlet pressure. Support for this language is drawn from the Specification, inter alia, page 20, lines 13-17.

In view of the above amendments and remarks it is respectfully submitted that claims 1-2, and 25-38, are in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



Mark M. Friedman
Attorney for Applicant
Registration No. 33,883

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